Patent Claims

1. Multi-mirror-system for an illumination system with wavelengths ≤ 193 nm
comprising an imaging system, wherein said imaging system comprises least a first mirror (5) and a second mirror (7)

1.1 an object plane (3)

1.2 an image plane (9), wherein the imaging system forms an image of the object

1.3 an arc-shaped field in said image plane (9), whereby the radial direction in the middle the arc-shaped field defines a scanning direction

1.4 at least said first mirror (5) and said second mirror (7) of said imaging system are arranged in the optical path of the imaging system in such a position and having such a shape, that the edge sharpness of the arc-shaped field in the image plane is smaller than 5 mm in scanning direction, whereby the edge sharpness is defined as the difference of the greatest value and the smallest value in scanning direction of points of an spot diagramm in the image plane for an edge field point of the arc-shaped-field

1.5 the rays travelling from the object plane (3) to the image plane (9) in the imaging system are impinging the first (5) and the second mirror (7) defining a first and a second used area on the mirrors, characterized in that

1.6 the rays are impinging the first (5) and the second mirror (7) in the used area with incidence angles relative to the surface normal of the mirror $\leq 30°$ or $\geq 60°$.

2. Multi-mirror-system according to claim 1,
characterized in that the edge sharpness of the arc-shaped-field in the image plane is smaller than 2 mm, preferably 1 mm.

3. Multi-mirror-system according to claim 1 or 2, characterized in that the incidence angles relative to the surface normal of the mirror are $\leq$ 20° or $\geq$ 70°.

4. Multi-mirror-system according to one of the claims 1 to 3, characterized in that at least said first mirror (5) and said second mirror (7) of said imaging system are arranged in the optical path of the imaging system in such a position and having such a shape, that the edge sharpness of the arc-shaped field in the image plane is smaller than 5 mm, preferably 2 mm, most preferably 1 mm in the direction perpendicular to the scanning direction, whereby the edge sharpness is defined as the difference of the greatest value and the smallest value perpendicular to the scanning direction of points of an spot diagramm in the image plane for an edge field point of the arc-shaped-field

5. Multi-mirror-system according to one of the claims 1 to 4, characterized in that the object in the object plane (3) is an arc-shaped field.

6. Multi-mirror-system according to one of the claims 1 to 5, characterized in that, the magnification ratio of the field imaged by the imaging system is unequal to 1.

7. Multi-mirror-system according to one of the claims 1 to 6, characterized in that, the imaging system is a non centred system.

8. Multi-mirror-system according to one of the claims 1 to 7, characterized in that,

a field stop is located in or close to the object plane (3).

9. Multi-mirror-system according to one of the claims 1 to 8, characterized in that, the imaging system comprises an exit pupil (10) and an aperture stop is located on or close to the plane (42) conjugate to the exit pupil (10).

10. Multi-mirror-system according to one of the claims 1 to 9, characterized in that, the imaging system comprises an exit pupil (10) and said first mirror is positioned close to the plane (42) conjugate to the exit pupil (10).

11. Multi-mirror-system according to one of the claims 1 to 10, characterized in that, said first and/or the second mirror is an aspheric mirror.

12. Multi-mirror-system according to one of the claims 1 to 11, characterized in that, the first mirror (5) is a concave mirror having a nearly hyperbolic form or a nearly elliptic form and is defining a first axis of rotation (50).

13. Multi-mirror-system according to one of the claims 1 to 12, characterized in that, the second mirror (7) is a concave mirror having a nearly hyperbolic form or a nearly elliptic form and is defining a second axis of rotation (52).

14. Multi-mirror-system according to one of the claims 12 to 13, characterized in that,

the first (5) and the second mirror (7) is comprising a used area in which the rays travelling through the imaging system are impinging the first and the second mirror; the used area is arranged off-axis in respect to the first and second axis of rotation.

15. Multi-mirror-system according to claim 12 to 14, characterized in that, the first axis of rotation (50) and the second axis of rotation (52) subtend an angle γ and the first mirror and the second mirror are defining a first magnification for the chief ray travelling through the centre of the field and the centre of the exit pupil, a second magnification for the upper COMA ray travelling through the centre of the field and the upper edge of the exit pupil and a third magnification for the lower COMA ray travelling through the centre of the field and the lower edge of the exit pupil, whereby the angle γ between the first (50) and the second (52) axis of rotation is chosen such that the first, the second and the third magnification is nearly identical.

16. Multi-mirror-system for an illumination system for lithography with wavelengths $\leq$ 193 nm comprising an imaging system, wherein said imaging system comprises

16.1. an object plane (3)

16.2 an image plane (9), wherein the imaging system forms an image of the object

16.3 an arc-shaped field in said image plane (9),

16.4 characterized in that said imaging system comprises at least a normal incidence mirror (5, 7) and a field forming optical component for producing an arc-shaped field in said image plant (9) whereby

16.5 said field forming component comprises at least a mirror.

17. Multi-mirror-system according to claim 16, characterized in that the object in the object plane is an arbitrary field.

18. Multi-mirror-system according to one of the claim 17, characterized in that, the field in the object plane is a rectangular field and the rectangular field is formed into an arc-shaped field in the image plane by the field forming optical component.

19. Multi-mirror-system according to one of the claims 16 to 18, characterized in that, said grazing incidence mirror has negative optical power.

20. Multi-mirror-system according to one of the claims 16 to 18, characterized in that, said field forming component comprises a first grazing incidence mirror with positive optical power and a second grazing incidence mirror for rotating the field.

21. Multi-mirror-system according to one of the claims 16 to 20, characterized in that, said imaging system comprises two normal incidence mirrors (5, 7) and one grazing incidence mirror (306) as field forming component.

22. Multi-mirror-system according to one of the claim 16 to 21, characterized in that, the multi-mirror-system comprises a field stop located in the object plane.

23. Multi-mirror-system according to one of the claims 16 to 22, characterized in that,
the magnification ratio of the field imaged by the imaging system is unequal to 1.

24. Multi-mirror-system according to one of the claims 16 to 23, characterized in that,
said at least normal incidence mirror(s) and/or said first grazing incidence mirror and/or said second grazing incidence mirror is an (are) aspheric mirror(s).

25. Multi-mirror-system according to one of the claims 16 to 24, characterized in that,
said field forming component is positioned close to the image plane.

26. Multi-mirror-system according to one of the claims 16 to 25, characterized in that,
said at least normal incidence mirror(s) and/or the first grazing incidence mirror and/or the second grazing incidence mirror is (are) comprising a used area in which the rays travelling through the imaging system is impinging the at least normal incidence mirror(s) and/or the first grazing incidence mirror and/or the second grazing incidence mirror and said used area is arranged off-axis with regard to the first axis.

27. Illumination system, especially for lithography with wavelengths $\leq$ 193 nm
comprising
27.1 a light source
27.2 a multi-mirror system comprising an imaging system, whereby the imaging system comprises an object plane

27.3 an optical component for forming an arc-shaped field in the object plane of the multi-mirror-system
characterized in that

27.4 the multi-mirror-system is a system according to one of the claims 1 to 15 for imaging the field in the object plane into the image plane of the imaging system.

28. Multi-mirror-system according to claim 27,
characterized in that,
the illumination system comprises at least one mirror or one lens which is or which are comprising raster elements for forming secondary light sources.

29. Illumination system, especially for lithography with wave lengths ≤ 193 nm
comprising

29.1 a light source

29.2 a multi-mirror-system comprising an imaging system, whereby the imaging system comprises an object plane

29.3 an arbitrary field in said object plane

29.4 at least one mirror or lens device comprising at least one mirror or one lens, which is or are comprising raster elements for forming secondary light sources
characterized in that

29.5 the illumination system comprises a multi-mirror-system according to one of the claims 16 to 26.

30. EUV-projection exposure unit for microlithography comprising

30.1 an illumination system according to at least one of the claims 27 to 29 with an exit pupil

30.2 a mask on a carrier system, said mask being positioned in the image plane of the imaging system

30.3 a projection objective with an entrance pupil, said entrance pupil being in the same plane as the exit pupil of the illumination system

30.4 a light sensitive object on a carrier system.

31. EUV-projection exposure unit according to claim 30, designed as a scanning system.

32. Process for producing microelectronic devices, especially semiconductor chips with a EUV-projection exposure unit according to claims 30 to 31.